

## PATENT COOPERATION TREATY

From the  
INTERNATIONAL SEARCHING AUTHORITYTo:  
KFIR LUZZATTO  
P.O. BOX 5352  
BEER SHEVA, ISRAEL 84152

PCT

#2

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing  
(day/month/year)

15 JUL 2005

Applicant's or agent's file reference 18471-WO-04		FOR FURTHER ACTION See paragraph 2 below	
International application No. PCT/IL04/01069	International filing date (day/month/year) 19 November 2004 (19.11.2004)	Priority date (day/month/year) 19 November 2003 (19.11.2003)	
International Patent Classification (IPC) or both national classification and IPC IPC6: G06F 15/80 and US Cl.: 345/505			
Applicant LUCID INFORMATION TECHNOLOGY LTD			

## 1. This opinion contains indications relating to the following items:

<input checked="" type="checkbox"/> Box No. I	Basis of the opinion
<input type="checkbox"/> Box No. II	Priority
<input type="checkbox"/> Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
<input type="checkbox"/> Box No. IV	Lack of unity of invention
<input checked="" type="checkbox"/> Box No. V	Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
<input type="checkbox"/> Box No. VI	Certain documents cited
<input type="checkbox"/> Box No. VII	Certain defects in the international application
<input type="checkbox"/> Box No. VIII	Certain observations on the international application

## 2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

## 3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/ US Mail Stop PCT, Attn: ISA/ US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22314-1450 Facsimile No. (703) 305-3230	Authorized officer Kee M. Tung Telephone No. 571-272-2600	
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Form PCT/ISA/237 (cover sheet) (January 2004)

THOMAS J. PERKOWSKI ESQ. P.C.  
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WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/IL04/01069

Box No. I Basis of this opinion

1. With regard to the language, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

This opinion has been established on the basis of a translation from the original language into the following language \_\_\_\_\_, which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).

2. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

a. type of material

a sequence listing  
 table(s) related to the sequence listing

b. format of material

in written format  
 in computer readable form

c. time of filing/furnishing

contained in international application as filed.  
 filed together with the international application in computer readable form.  
 furnished subsequently to this Authority for the purposes of search.

3.  In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

Form PCT/ISA/237(Box No. I) (January 2004)

From the  
INTERNATIONAL SEARCHING AUTHORITY

PATENT COOPERATION TREATY

To:  
KFIR LUZZATO  
P.O. BOX 5352  
BEER SHEVA, ISRAEL 84152

PCT

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing  
(day/month/year)

15 JUL 2005

Applicant's or agent's file reference 18471-WO-04	FOR FURTHER ACTION See paragraph 2 below	
International application No. PCT/IL04/01069	International filing date (day/month/year) 19 November 2004 (19.11.2004)	Priority date (day/month/year) 19 November 2003 (19.11.2003)
International Patent Classification (IPC) or both national classification and IPC IPC(7): G06F 15/80 and US Cl.: 345/505		
Applicant LUCID INFORMATION TECHNOLOGY LTD		

1. This opinion contains indications relating to the following items:

<input checked="" type="checkbox"/>	Box No. I	Basis of the opinion
<input type="checkbox"/>	Box No. II	Priority
<input type="checkbox"/>	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
<input type="checkbox"/>	Box No. IV	Lack of unity of invention
<input checked="" type="checkbox"/>	Box No. V	Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
<input type="checkbox"/>	Box No. VI	Certain documents cited
<input type="checkbox"/>	Box No. VII	Certain defects in the international application
<input type="checkbox"/>	Box No. VIII	Certain observations on the international application

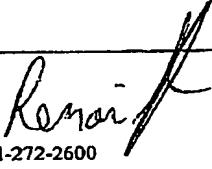
2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703) 305-3230	Authorized officer Kee M. Tung Telephone No. 571-272-2600	
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WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

International application No.  
PCT/IL04/01069

Box No. V Reasoned statement under Rule 43 bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement			
Novelty (N)	Claims 1-13	YES	
	Claims NONE	NO	
Inventive step (IS)	Claims 12	YES	
	Claims 1-11 and 13	NO	
Industrial applicability (IA)	Claims 1-13	YES	
	Claims NONE	NO	
2. Citations and explanations:			
<p>Claims 1-11 and 13 lack an inventive step under PCT Article 33(3) as being obvious over Celi, Jr. et al (US 5,745,762 hereinafter "Celi") in view of Narayanaswami et al (US 5,757,385 hereinafter "Nara") and Molnar et al (PixelFlow: High-Speed Rendering Using Image Composition, hereinafter "Molnar"). Celi teaches a system (Figs. 1 and 2) for improving parallelization of image processing (38a and 38 b), using one or more parallelization modes (Not suggest in particularly, see Molnar and Nara below), wherein said image is displayed on at least one computer screen (39) by one or more GPUs (38a and 38b), comprising one or more software application (25), for issuing graphics commands; one or more graphics libraries (60), for storing data used to implement said graphics commands; one or more software hub drivers (55) for controlling a hardware hub (34), for interacting with the OS of said computer and said graphics libraries, for performing real-time analysis of a data stream, for which frames of said image are generated, for determining the parallelization mode of each GPU, and for forwarding said data stream or a portion thereof to each GPU; one or more GPU drivers (50a and 50b) for allowing said GPUs to interact with said graphics libraries; and at least one I/O module (not shown, but is well known and the art for an example, a chipset or core logic), for interconnecting between said software module and said hardware hub, wherein said hardware hub distributes, for each frame, between said GPUs, graphics commands and said data stream or a portion thereof, according to their relative complexity within said image, said complexity is defined by said software hub driver, and composites (into frame buffer 52 and further see Molnar) a graphics output for display, using the outputs obtained from at least one GPU, while alternating, whenever required, said parallelization mode for said each frame. However, Celi fails to explicitly teach or suggest the different parallelization modes. Molnar teaches a high-speed rendering using image composition includes screen subdivision and image composition (Figs. 1a and 1b and page 232). Nara also teaches a method and apparatus for managing multiprocessor graphics workload distribution (Figs. 3A and -3C) by using different distribution approaches, for example, round robin, stripe allocation and mix allocation procedure for dynamically load balance over time based on various factors. It would have been obvious to one of ordinary skill in the art at the time the present invention was made to combine the teachings of Molnar and Nara into the system of Celi in order to achieve higher rendering performance as suggested by Molnar (page 232, col. 1) and dynamic load balance or distribution of Nara (col. 4, line 55 to col. 5, line 19). Therefore, claims 1-11 and 13 lack an inventive step as being obvious by Celi, Nara and Molnar.</p> <p>Claim 12 meets the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest the claimed steps, in combination with the remaining steps, a method comprising testing each graphics operation for blocking mode, redirecting the data in regular non-blocking path to at least one designated GPU, synchronizing GPU by the following sequence and terminating the composited complete frame ... as recited in claim 12.</p>			

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/IL04/01069

## Box IV TEXT OF THE ABSTRACT (Continuation of Item 5 of the first sheet)

The technical features mentioned in the abstract do not include a reference sign between parentheses (PCT Rule 8.1(d)).

## NEW ABSTRACT

Method and system for improving the parallelization of image processing, using one or more parallelization modes, wherein the image that is displayed on at least one computer screen, by one or more graphics processing units (GPUs) (130), software applications (121) are provided for issuing graphics command and graphics libraries (122) are provided for storing data used to implement the graphics commands. A software hub driver (123) is provided for controlling a hardware hub (110), for performing real-time analysis of a data stream, from which frames of the image are generated, for determining the parallelization mode of each GPU, and for forwarding the data stream or a portion thereof to each GPU. GPU drivers (124) are provided for allowing the GPUs to interact with the graphics libraries and an I/O module (160) is provided for interconnecting between the software module and the hardware hub.

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## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 18471-WO-04	FOR FURTHER ACTION	See Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No. PCT/IL04/01069	International filing date (day/month/year) 19 November 2004 (19.11.2004)	(Earliest) Priority Date (day/month/year) 19 November 2003 (19.11.2003)
Applicant LUCID INFORMATION TECHNOLOGY LTD		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 1 sheets.



It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the Report	
a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.	<input type="checkbox"/> The international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).
b. <input type="checkbox"/>	With regard to any nucleotide and/or amino acid sequence disclosed in the international application, see Box No. I.
2. <input type="checkbox"/>	Certain claims were found unsearchable (See Box No. II)
3. <input type="checkbox"/>	Unity of invention is lacking (See Box No. III)
4. With regard to the title, <input checked="" type="checkbox"/>	the text is approved as submitted by the applicant.
	the text has been established by this Authority to read as follows:
5. With regard to the abstract, <input type="checkbox"/>	the text is approved as submitted by the applicant.
<input checked="" type="checkbox"/>	the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.
6. With regard to the drawings,	
a. the figure of the drawings to be published with the abstract is Figure No. <u>1</u>	
<input type="checkbox"/>	as suggested by the applicant.
<input checked="" type="checkbox"/>	as selected by this Authority, because the applicant failed to suggest a figure.
<input type="checkbox"/>	as selected by this Authority, because this figure better characterizes the invention.
b. none of the figures is to be published with the abstract	

Form PCT/ISA/210 (first sheet) (January 2004)

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/01069

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G06F 15/80  
US CL : 345/505

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
U.S. : 345/501-503, 505, 519, 520; 718/100, 102, 104, 105, 107; 719/321-324, 327, 328.Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
noneElectronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
Please See Continuation Sheet

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,745,762 A (CELI, Jr. et al) 28 April 1998, Figures 1 and 2, abstract, col. 1, lines 50-60; col. 2, lines 12-28, lines 60-64; col. 3, lines 12-14, 23-45; col. 4, lines 30-67; col. 5, lines 1-64; col. 6, lines 26-67; col. 12, lines 22-67; col. 13, line 4 to col. 15, line 41	1-11 and 13
Y	US 5,757,385 A (NARAYANASWAM et al) 26 May 1998, Figures 2-4, col. 2, line 65 to col. 5, line 43; col. 5, line 64 to col. 7, line 3.	1-11 and 13
A	US 6,362,825 A (JOHNSON) 26 March 2002, Fig. 3, and col. 7, line 62 to col. 8, line 59.	1-13
Y	MOLNAR et al, PixelFlow: High-Speed Rendering Using Image Composition, Computer Graphics, Vol. 26, No. 2, July 1992, Fig. 1a and 1B, pages 231-237.	1-11 and 13
A	Li et al, ParVox - A Parallel Splatting Volume Rendering System for Distributed Visualization, IEEE Symposium on Parallel Rendering, Oct 1997, pages 9-11.	1-13

 Further documents are listed in the continuation of Box C. See parent family annex.

Special categories of cited documents:	
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"B" earlier application or patent published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"E" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

30 June 2005 (30.06.2005)

Date of mailing of the international search report

15 JUL 2005

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
Facsimile No. (703) 305-3230

Authorized officer

Kee M. Tung

Telephone No. 703-272-2600

Form PCT/ISA/210 (second sheet) (January 2004)

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## INTERNATIONAL SEARCH REPORT

International application No. PCT/IL04/01059
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Continuation of B. FIELDS SEARCHED Item 3:  
DATABASES: EAST, ACM and IEEE; search terms: load balance, parallel processing, graphics driver, application program interface.